Childhood and Adolescent Immunization Programs in Europe

Pierre Van Damme

Contents

T. Vesikari, P. Van Damme (eds.), *Pediatric Vaccines and Vaccinations*,
https://doi.org/10.1007/978-3-030-77173-7_3

3

3.1 Introduction

In 2005, the World Health Assembly adopted resolution WHA58.15 on global immunization strategy. It "urged Member States to meet immunization targets expressed in the United Nations General Assembly special session on children; to adopt the Strategy as the framework for strengthening of national immunization programmes, with the goal of achieving greater coverage and equity in access to immunizations, of improving access to existing and future vaccines, and of extending the benefits of vaccination linked with other health interventions to age groups beyond infancy; to ensure that immunization remains a priority on the national health agenda, …."

The diversity of the European Region is reflected not only in the cultures and languages but also by economies and health systems. The economic, cultural, and historical differences have all contributed to the resulting diversity seen in the health systems and health governance among them, differences that have contributed to the wide variation of immunization programs currently in place.

All Member States of the European Union and a large number of the non-EU countries in the WHO European Region have a national immunization technical advisory group (NITAG) on immunization, and most of these NITAGs have a legislative basis for making recommendations to the government (i.e., the Ministry of Health). The effect of the recommendations varies according to how immunization programs are organized (centralized or decentralized) and the balance between public and private sector provision of services. In countries such as Belgium, Germany, and Spain, the communities (Belgium), the Länder (Germany), or the "autonomous regions" (Spain) have the responsibility for prevention and protection of public health. Although each country has a NITAG, its recommendations can be applied differently at the local level, and the vaccines actually provided depend on the choice of private practitioners and reimbursement arrangements with insurance companies, or on the (de)centralized public policy of the (local) government.

Immunization policy or practice has not been subject to European legislation for harmonization, although many relevant processes such as batch release are controlled through EU legislation.

The vaccines and immunization schedules used in the 53 countries of the WHO European Region are undergoing continuous change, with the introduction of new antigens and the increasing use of combined antigen vaccines and simplified schedules with a lower number of vaccine doses. Annual information is collected from WHO Member States on immunization programs and vaccine-preventable diseases using the WHO/UNICEF joint reporting form. This information can easily be consulted through the WHO website at: ► http://apps.who.int/immunization_monitoring/globalsummary/schedules. ECDC offers a *Vaccine Scheduler* tool; it is an interactive platform of *vaccination schedules* for individual European countries and specific age groups (► http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx).

Country immunization schedules can be consulted by vaccine or target disease, or compared with each other.

3.2 Childhood Vaccination

In Europe, childhood vaccination is offered through routine immunization programs at "well-baby" clinics, through the private sector (general practitioners or pediatricians), or through a combination of both public and private sector.

The current childhood immunization schedules for vaccination below 24 months of age in the EU countries can be divided into four major groups for the infant vaccination schedule:

- **Group 1**

Early-onset 3 plus 1 schedule with vaccination at 2, 3, and 4 months of age (Bulgaria, Germany, Hungary, Luxemburg, Malta, and Belgium using timings of 8, 12, and 16 weeks) or the schedule similar to that of the USA of 2, 4, and 6 months of age (Croatia, Cyprus,

Greece, Ireland, Latvia, Liechtenstein, Lithuania, Poland, and Portugal), all followed by a fourth dose in the second year of life.

- **Group 2**

Early onset according to a 2 plus 1 schedule, with vaccination at 2 and 4 months, followed by a third dose at 11 months (France, Romania, Slovakia, and Spain).

- **Group 3**

Late-onset 2 plus 1 schedule with vaccination at 3 and 5 months of age followed by a third dose at 12 months of age (Austria, Czech Republic, Denmark, Finland, Iceland, Italy, Norway, Slovenia, Sweden, and the Netherlands).

- **Group 4**

Late-onset 3 plus 1, starting at the age of 3 months (Estonia), with a fourth dose in the second year of life.

Only one or two countries use only a three-dose primary immunization schedule with no penta- or hexavalent booster in the second year of life. In the remaining WHO European Region countries, the Extended Program of Immunization (EPI) schedule is often implemented together with primary infant immunization offered at 6, 10, and 14 weeks – in some countries followed by infant booster immunization.

The various childhood immunization schedules in Europe evolved historically, taking into consideration the local vaccine-preventable infection epidemiology, and were based on the experiences gained from immunization with whole-cell pertussis-containing diphtheria–tetanus–pertussis (DTP) vaccines (2-, 3-, 4- and 2-, 4-, 6-month schedules), where the need for three doses was shown. The 3- and 5-month schedule, on the other hand, evolved from the vaccination priming schedule for the diphtheria–tetanus (DT) vaccine, which was introduced first in Italy in 1981 and in Sweden in 1986. That schedule was maintained in a number of countries when a pertussis vaccine was added to DT.

The four different schedules used in Europe have been shown to accomplish their primary goal, i.e., to induce rapid protection and immunological memory against the vaccine-preventable infections targeted by the immunization, in close to 100% of vaccinated infants. By starting at 2 months of age (or 8 weeks, which offers a smaller range than 2 months), protection will be achieved 1 month earlier than with a 3-, 4-, and 5-month schedule or 3- and 5-month schedule.

A measurable antibody response does not develop in all children after the priming doses, and the level of the antibody responses may be low. The booster dose will induce measurable antibody responses in almost 100% of children and result in much higher antibody levels than after the priming doses.

European vaccination schedules all call for at least one or two booster doses between the ages of 2 and 18 years, but with quite a variation in local schedules. Such a variation creates issues for migrating families, as parents and physicians have to face difficult decisions on how to adapt or complete vaccination schedules when families move from one European country to another.

3.3 Adolescent Vaccination

Vaccinating adolescents offers three types of immunization opportunities: catch-up on missed vaccinations, boosting waning immunity (derived from previous childhood vaccinations such as for pertussis), and the achievement of primary immunization through administration of new vaccines best delivered during adolescence (e.g., meningococcal and human papillomavirus vaccines; ◘ Table 3.1). In the future, adolescence may also be the target age range for administration of some vaccines currently in development.

Adolescent vaccination can prevent considerable morbidity in adolescent and adult age groups and limit the spread of infectious diseases in the population. In Europe, adolescent vaccination can be provided through routine immunization programs or campaigns, run with the support and participation of either the private sector or the public sector, or both. Vaccines can be administered through clinic-based schemes (e.g., in health centers),

Table 3.1 Examples, advantages, and disadvantages of adolescent vaccination strategies (Brabin et al. 2008)

Vaccine implementation			
Strategy	Example vaccine	Advantages for adolescent programs	Disadvantages for adolescent programs
Universal	Meningococcal conjugate (MCV4)	Increased likelihood of achieving herd immunity	The ability to achieve herd immunity is undermined if low vaccination rates occur
		Decreased likelihood of inducing stigma around certain diseases such as sexually transmitted infections	Higher costs to society
Targeted	Hepatitis B virus (HBV)	Reduced costs if every adolescent does not require vaccination	Target groups can be difficult to identify
			Adolescents may not perceive themselves to be high risk
		Reduced risk of adverse events in the whole population	Adolescents may be unwilling to seek care if fear of judgment or lack of confidentiality exists, especially for sexually transmitted infections
			Increased risk of stigmatization, particularly for sexually transmitted infections
School-based	Rubella (MMR, MR, or R)	In countries with school-based programs, success has been mediated by the requirement to attend school and by a lack of private sector healthcare	School attendance by adolescents is low in many countries
			School-based healthcare infrastructure is generally directed at younger children; therefore, retention and/or creation of appropriate infrastructures in many countries need to be developed to create an adolescent program
			Future adolescent vaccines targeted at sexually transmitted diseases necessitate integration with health promotion; in particular, sexual health issues associated with absenteeism require development of catch-up programs
Catch-up	Pertussis (Tdap)	Maintain immunity to prevent infection and subsequent infection of un-immunized individuals	Timing of catch-up programs needs to coincide with other preventive services to increase the likelihood of vaccination uptake
		Reduced healthcare costs associated with decreased disease burden	

Table 3.1 (continued)

Vaccine implementation			
Mass vaccination	Typhoid fever (Ty21a, Vi)	Large number of individuals can be vaccinated within a rapid timeframe	Suitable for single-dose vaccinations; however, less effective for multi-dose vaccines, as the likelihood of individuals returning for subsequent vaccination decreases with each additional dose
		Excellent for outbreak situations	
		Limited amount of resources can be mobilized	

in the community, or in schools. Mixed systems of school health and private sector can offer benefits, but require coherence, coordination, and good communication between all parties.

However, because of the age of the target group – the WHO definition of an adolescent being aged between 10 and 19 – legal issues arise: parental consent, minors' consent (assent) and legality thereof, the concept of "capacity to understand" and "competence," and action in case of parental opposition. Another feature that emerges is the disconnect between the practice of immunization and other medical procedures ("treatment"), including the role of school health services in dealing with other health problems, such as drug use, alcohol use, and violence.

Furthermore, medical issues in this age range also complicate the matter of immunization; a substantial proportion (about 10%) of young people suffer from chronic illnesses (e.g., diabetes, whose incidence in young people is increasing) that need to be considered before vaccination is given. Other temporal, coincidental associations in adolescents, e.g., asthma, autoimmune thyroiditis, and Guillain–Barré syndrome may raise safety concerns.

In Europe, as for the implementation of the childhood immunization program, the adolescent program differs by country and sometimes by state, region, or canton and involves the public and/or private sectors.

In general, in Europe, adolescent immunizations lag behind childhood uptake figures, in particular for the second dose of measles, mumps, and rubella vaccine, the booster dose of the pertussis vaccine, or the uptake of human papillomavirus vaccines. Waning immunity or absence of immunity in adolescents makes them reservoirs of infection, with transmission possibilities to other age groups in the population. In many countries, adolescents are an underserved group that is hard to reach because of their good health and sparse preventive medicine visits.

Studies among adolescents have identified risk factors associated with suboptimal immunization, which may include financial and logistic constraints, in addition to parental and adolescent knowledge and beliefs: e.g., socioeconomic status, lack of medical insurance, large family size, divorced parents, foreign nationality, and language barriers.

School health services have been identified as playing a specific role in the prevention and response to adolescent health problems (Table 3.2). Where there were no strong school health facilities or vaccine programs, such as in France, Germany, and Italy, rates of adolescent vaccination have been low. With school attendance mandatory for high proportions of adolescents in Europe, the

Table 3.2 School health system per country: vaccine type and school health system

Country	Coverage	Vaccine	School health system
Belgium	>68–75%	Hepatitis B	Present
Croatia	>93%	Hepatitis B	Present
Finland	Estimated 95%	Not specified	Present
France	35–95%	Not specified	No longer existing since 1998
Germany	Low coverage in adolescents	Not specified	Not present
Greece	18–45%	Not specified	Not present
Hungary	>99%	Not specified	Present
Italy	>90%	Hepatitis B	Present
Norway	90–92%	Not specified	Present
Slovenia	92–99%	Not specified	Present
The Netherlands	>90%	Not specified	Present
Turkey	85–98%	Not specified	Present

Adapted from FitzSimons et al. (2007)

presence of a captive audience makes vaccination at school feasible. Benefits of school health programs (besides high coverage rates) include easy access to vaccination for parents (no effort required from them) and easy monitoring of coverage and side effects. On the down side, school immunization programs form only one part of a school medicine system and cannot manage common adolescent problems including smoking, alcohol and drug use, sexual behavior, and violence, unless it is fully embedded in a comprehensive program. In addition, communication with parents is indirect, which can raise some legal issues.

The introduction of a centralized immunization information system (enabling recording, recall, and informing healthcare workers and parents), the organization of a school health program, offering the vaccine free of charge, and the implementation of school-entry mandates have been recognized as factors that could contribute to improved vaccination coverage in adolescents. In addition, advocacy and educational initiatives for parents, adolescents, and vaccinators should help to support these programs and safeguard the health of adolescents.

The concept of promoting health in schools seems to be successfully taking off, but healthcare providers alone cannot meet adolescents' needs: there has to be a partnership and networking of vaccinators, teachers, parents, and young people all playing a role. Vaccination should be integrated into other interventions in health systems (e.g., sexual health education and sports medical examinations). Various approaches are currently being successfully used by different countries to reach adolescents.

3.4 Vaccination of Refugees and Immigrants

Since 2011, Europe has been facing one of the greatest migration inflows in its history: during 2011, there were an estimated 1.7 million immigrants into the EU from countries outside the

EU. According to Eurostat, after the Northern African turmoil, in 2012, EU countries received 300,000 asylum applications, which peaked at 1,300,000 in 2015, after the Syrian conflict and almost double the previous great migration inflow recorded in 1992, after the crisis in the former Yugoslavia. The UNHCR estimated that, in 2015, more than one million migrants arrived in Europe after crossing the Mediterranean Sea. Refugees and immigrants often come from countries in which poverty-related diseases are endemic, with disrupted healthcare systems and consequently a fall in vaccination coverage. This explains why they are at a high risk of vaccine-preventable diseases, not to mention the risky conditions they endure during the journey to Europe (unsanitary conditions, overcrowding).

Overall, migrants and refugees have lower immunization rates than European-born individuals, with children being at a higher risk of being unvaccinated against measles, mumps, and rubella (MMR; ◘ Table 3.3). The coverage for the oral polio vaccine has been estimated to be less than 15% among Syrian children refugees in Germany.

In 2016, the WHO, UNICEF, and UNHCR officially stated that migrants, asylum seekers, and refugees should have nondiscriminatory and equitable access to vaccinations. They recommended vaccinating these populations; avoiding delays, in accordance with the immunization schedule of the host country; and offering documentation of administered vaccines to avoid duplications.

However, access to complete vaccination is difficult to ensure: migrants are moving throughout Europe, whereas vaccines must often be given in consecutive doses; information on the immunization status of the migrants is often lacking; recommended immunization schedules differ among EU countries complicating the catch-up programs; a number of the host countries face severe economic crises, challenging migrants' access to the local healthcare services; migrants may refuse registration by medical authorities for the fear of legal consequences; a lack of coordination among EU public health authorities may cause either a lack of vaccine administration or duplication.

Although migrants have the right to healthcare under legal settlements issued by the EU, there is no standard European approach for offering healthcare to migrants. Each country has its own policy.

To overcome many of these issues at the EU or country level, the WHO proposes tailoring immunization services to the specific needs of the target population, to strengthen social mobilization, advocacy, and communication toward these specific populations, to develop electronic vaccination registries, and to introduce coordination among public health authorities of EU countries.

In general, the vaccination status of migrants and refugees arriving in Europe should first be assessed through documentation; when this is lacking, they should be regarded as unvaccinated and should then be vaccinated according to the local recommended schedule. Catch-up immunization programs should prioritize MMR and inactivated poliovirus vaccines, followed by the DTP vaccines and hepatitis B vaccine (depending on the age after first screening). Vaccination against polio should be considered a high priority for migrants coming from countries in which polio is endemic. In 2016, some countries or regions (e.g., Flanders) started to offer asylum seekers polio (when indicated), MMR and diphtheria, tetanus, and acellular pertussis vaccination (for pregnant women) immediately on entry into the country, with further follow-up of the immunization in the respective centers for asylum seekers. Recently in a number of EU countries (e.g. Belgium) also COVID19 vaccines are offered to refugees and saylum seekers.

Clearly, under-immunization and therefore susceptibility to vaccine-preventable infections pose a risk to the health of migrants and refugees and, in turn, can result in epidemics in the host country.

Table 3.3 Immunization coverage (in %) for 2014, according to the estimates of the WHO and UNICEF for six of the most frequent countries of origin of migrants arriving in Europe (2012), compared with five EU countries (Mipatrini et al. 2017)

Vaccine	Code	Syria	Iraq	Afghanistan	Albania	Pakistan	Eritrea	Italy	Greece	Germany	Denmark	Sweden
Bacillus Calmette–Guerin	BCG	81	95	86	99	85	97	–	–	–	–	–
Diphtheria–tetanus–pertussis first dose	DTP1	65	77	82	99	79	97	98	99	98	96	99
Diphtheria–tetanus–pertussis third dose	DTP3	43	64	75	98	72	94	94	99	96	94	98
HBV third dose	HepB3	71	62	75	98	72	94	94	96	87	–	53
HBV birth dose	HepB_BD	78	43	4	99	–	–	–	–	–	–	–
Haemophilus influenzae third dose	Hb3	43	64	75	98	72	94	94	99	94	94	98
Measles-containing vaccine first dose	MCV1	54	57	66	98	61	96	86	97	97	90	98
Measles-containing vaccine second dose	MCV2	49	57	39	98	52	–	–	83	92	84	95
Maternal immunization with ≥2 doses of tetanus toxoid	PAB	92	72	70	92	75	94	–	–	–	–	–
Pneumococcal conjugate vaccine	PCV3	–	–	40	99	72	–	55	96	69	93	97
Polio vaccine third dose	Pol3	52	67	75	98	72	94	94	99	95	94	98
Rotavirus	RotaC	–	29	–	–	–	25	–	–	–	–	–

Bibliography

Bearinger LH, Sieving RE, Ferguson J, Sharma V. Global perspectives on the sexual and reproductive health of adolescents: patterns, prevention, and potential. Lancet. 2007;369(9568):1220–31.

Brabin L, Greenberg DP, Hessel L, Hyer R, Ivanoff B, Van Damme P. Current issues in adolescent immunization. Vaccine. 2008;26(33):4120–34.

ECDC. Scientific panel on childhood immunisation schedule: diphtheria-tetanus-pertussis (DTP) vaccination – report. European centre for disease prevention and control, Stockholm. 2009, 40p.

FitzSimons D, Vorsters A, Hoppenbrouwers K, Van Damme P, Viral Hepatitis Prevention Board (VHPB), European Union for School and University Health and Medicine (EUSUHM). Prevention and control of viral hepatitis through adolescent health programmes in Europe. Vaccine. 2007;25(52):8651–9.

Keane MT, Walter MV, Patel BI, et al. Confidence in vaccination: a parent model. Vaccine. 2005;23(19):2486–93.

Kleinert S. Adolescent health: an opportunity not to be missed. Lancet. 2007;369(9567):1057–8.

Kpozehouen E, Heywood AE, Kay M, Smith M, Paudel P, Sheikh M, MacIntyre CR. Improving access to immunisation for migrants and refugees: recommendations from a stakeholder workshop. Aust N Z J Public Health. 2016;41(2):118–20.

Mipatrini D, Stefanelli P, Severoni S, Rezza G. Vaccinations in migrants and refugees: a challenge for European health systems. A systematic review of current scientific evidence. Pathog Glob Health. 2017;111(2):59–68.

Reyes-Uruena JM, Noori T, Pharris A, Jansà JM. New times for migrants' health in Europe. Rev Esp Sanid Penit. 2014;16(2):48–58.

Rosenthal SL, Kottenhahn RK, Biro FM, Succop PA. Hepatitis B vaccine acceptance among adolescents and their parents. J Adolesc Health. 1995;17(4):248–54.

Sakou I-I, Tsitsika A, Papaevangelou V, Tzavela E, et al. Vaccination coverage among adolescents and risk factors associated with incomplete immunization. Eur J Pediatr. 2011;170:1419–26.

Vandermeulen C, Roelants M, Theeten H, et al. Vaccination coverage and sociodemographic determinants of measles-mumps-rubella vaccination in three different age groups. Eur J Pediatr. 2008;167:1161–8.

Wallace LA, Young D, Brown A, et al. Costs of running a universal adolescent hepatitis B vaccination programme. Vaccine. 2005;23:5624–31.

Williams GA, Bacci S, Shadwick R, Tillmann T, Rechel B, Noori T, Suk JE, Odone A, Ingleby JD, Mladovsky P, Mckee M. Measles among migrants in the European Union and the European economic area. Scand J Public Health. 2016;44(1):6–13.

Wilson TR, Fishbein DB, Ellis PA, Edlavitch SA. The impact of a school entry law on adolescent immunization rates. J Adolesc Health. 2005;37(6):511–6.

Zimet GD, Liddon N, Rosenthal SL, Lazcano-Ponce E, Allen B. Psychosocial aspects of vaccine acceptability. Vaccine. 2006;24(Suppl 3):S201–9.